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ABSTRACT

Twenty-three learning disabled (LD) children (age 8-12 years) and 15 nondisabled children (age 8-12 years) were individually administered the Luria-Nebraska Neuropsychological Battery-Children's Revision (LNNB). Means and standard deviations for each of the test's scales were computed by group, and individual T-tests were calculated for differences between the mean scores for both groups on each scale. LD Ss appeared to score higher than brain damaged Ss of a previous study. In general, correlations between scales were higher for the LD than for the normal group. There was a strong correlation between the WISC-R Full Scale IQ and the LNNB for the LD Ss. Discriminant analysis revealed that the LNNB accurately classified 87% of the normal and 87% of the LD Ss. Stepwise discriminant function analysis revealed that the expressive scale was the variable that contributed the most of all eight measures to the significant group separation. It was concluded that the two groups were significantly different on this scale with the LD Ss having generalized expressive problems. (CL)

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INVESTIGATION OF THE LURIA-NEBRASKA NEUROPSYCHOLOGICAL BATTERY - CHILDREN'S REVISION with LEARNING DISABLED CHILDREN

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INVESTIGATION OF THE LURIA-NEBRASKA NEUROPSYCHOLOGICAL BATTERY - CHILDREN'S REVISION with LEARNING DISABLED CHILDREN

Recently there has been an increased recognition of the contribution of neuropsychological knowledge and assessment techniques by school psychologists working with learning disabled children (Gaddes, 1980; Hynd & Obrzut, 1981; Rourke & Gates, 1981). Federal legislation (PL-94-142) requires recognition of brain-behavior relationships involved in the learning process, knowledge of specific neurological disorders of childhood, more sophisticated assessment techniques for making differential diagnosis, and neuropsychological information pertinent to intervention strategies.

The Luria-Nebraska Neuropsychological Battery - Children's Revision (LNNB-Children's Revision) is a relatively new instrument that has been modified from the Luria-Nebraska Neuropsychological Battery (Golden, Hammeke, & Purisch, 1980). The LNNB-Children's Revision has been derived, in part, from the conceptual and practical work of the Russian neuropsychologist A. R. Luria (Luria, 1966, 1973; Christensen, 1975) with the selection of items based on a developmental model of neuropsychological functions (Golden, 1981). The battery is designed to provide neurological information for children 8 through 12 years of age. The instrument consists of 11 different scales including motor, rhythm, tactile, visual, receptive speech, expressive speech, writing, reading, math, memory, and intelligence. In addition, three scales, pathognomonic, left sensorimotor, and right sensorimotor are also available. The scales are comprised of a total of 149 items.

The LNNB-Children's Revision exhibits heuristic value for the investigation of learning problems of children. However, prior to its utilization by school psychologists, reliability and validity must be substantiated for

learning disabled students drawn from educational settings. Most of the current research on the LNNB-Children's Revision has been conducted on clinical populations of brain-damaged children. Preliminary research findings using "brain-damaged" and normal children, indicate that the battery does discriminate between these two groups (Wilkening, Golden, MacInnes, Plaisted & Hermann, 1981). Gustavson, Golden, Leark, Wilkening, Hermann and Plaisted (1982) conducted a cross-validation study on brain-damaged and normal children and reported a hit-rate of 85 percent discrimination of these two groups. In the same study (Gustavson, et al.), further analysis found a positive relationship between the Children's LNNB and the WISC-R, ranging from .86 with the Full Scale IQ, .83 with Verbal IQ, and .83 with the Performance IQ. The Arithmetic, Intellectual, and Visual scales showed the strongest correlations to IQ. It was also reported that the Children's LNNB correlates with the WRAT with coefficients ranging from .73 to .87. Leark, Gustavson, Wilkening, and Golden (1982) used multiple regression analysis to determine if the scales of the Battery could predict WISC-R scores. The findings indicated that the Intellectual scale was somewhat predictive at the lower end of abilities and weakest in predicting IQ for average to above average abilities. Another study (Gustavson, Wilkening, Hermann, and Plaisted, 1982) with brain-damaged children was examined through the use of a within scale factor analysis using all items within a particular scale as variables. The authors identified a total of 34 factors varying from a maximum of nine on the Motor scale to one factor on the arithmetic and reading scales.

These initial results yield promising evidence for the use of the LNNB-Children's Revision with clinical populations and subsequent clinical-oriented interpretations. Further evidence is required, however, on learning disabled children found in school settings in order to decide the utility of the Battery in assessment, diagnosis, and intervention. To date, only a few studies using

well defined school learning disabled children have been completed. Geary, Jennings, and Schultz (1982) found that the LNNB-Children's Revision discriminated school learning disabled children from normals with 86.7 percent accuracy. The authors also reported a strong correlation between the WISC-R and the Children's LNNB on all subscales. However, they found that the instrument falsely identified 20 percent of their normal population as learning disabled and suggested its use with caution. Nolan, Hammeke and Barkley (1982) found that the LNNB-Children's Revision successfully diagnosed children with learning disabilities in reading and spelling but did not differentiate children with arithmetic deficiencies. Another investigation using school learning disabled populations was conducted by Snow and Hynd (1983). The results of a factor analysis and varimax rotation indicated three factors including a language-general intellectual factor, a reading-written factor, and a sensory-motor factor. The authors suggest that while the Children's LNNB may distinguish learning disabled from normal children, the 11 scales should not be used in differential diagnosis of neuropsychological functions due to the lack of indepencence of each scale. Snow and Hynd (1983) examined the ability of the LNNB - Children's Revision to identify subgroups of learning-disabled children. They found that the three groups identified were very similar and the failure of the Battery to differentiate "meaningful" subgroups was suggested to be related to questionable construct validity.

This study, a portion of a larger project, was intended to add further data regarding the Children's LNNB and its use with school learning disabled children. This preliminary sample consisted of 23 learning disabled children (ages 8-12 years) previously diagnosed according to state and federal guidelines as having a significant discrepancy between achievement and ability. These children were required to exhibit average or better intelligence (IQ > 80)

and to demonstrate a deficit in reception, discrimination, association, organization/integration, retention, or application of information. The control group consisted of 15 normal children ranging from 8-12 years, and having average or above IQ. All subjects demonstrated right-hand preferences as measured by the Edinburgh Handedness Inventory (Oldfield, 1971). Each subject was individually administered the Luria-Nebraska Neuropsychological Battery-Children's Revision according to the standardized format. The items on the Battery are scored on a three-point system. A score of "0" indicates performance less than one standard deviation below the mean. Scores of "1" indicate performance between one and two standard deviations below the mean, and a score of "2" equals performance greater than two standard deviations below the mean. The sum of scores for each scale is converted to a T-score with a mean of 50 and a standard deviation of 10.

Results and Discussion

Means and standard deviations were computed for each of the LNNB-Children's Revision scales by group, and are presented graphically in Figure 1. In addition,

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Insert Figure 1 about here

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individual T-tests were calculated for differences between the mean scores for both groups on each scale. As can be seen in Table 1, all differences with the exception of the Visual scale, were significant at the .01 level of probability. These results are very similar to those reported by Gustavson et al. (1982)

Insert Table 1 about here

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comparing normal and brain damaged subjects of similar age. Visual inspection of the means for the various scales in both studies appeared to show that learning disabled subjects in the present study differed from the brain-damaged subjects in their study, on the memory and intelligence scales. In both cases

the learning disabled children performed at a better level.

Next, it was of interest to examine the interrelatedness of the LNNB-Children's scales separately by group. In general, the correlations between scales were higher for the learning disabled group than for the normal group. However, as shown in Tables 2 and 3, some scales yielded higher correlations

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Insert Tables 2 and 3 about here

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with other scales more consistently and this finding varied by group. For example, while the Expressive scale was highly correlated with the other scales for both groups, the Memory and Intelligence scales were highly correlated with the other scales only for the learning disabled group. In addition, the results also demonstrated that a strong correlation (.67) exists between the WISC-R Full Scale IQ and Children's LNNB Intelligence scale for the learning disabled population.

Because of the significant number of high correlations found among the scales for both groups, a discriminant analysis was undertaken in an attempt to independently establish the diagnostic accuracy and discriminating validity of the instrument. As shown in Table 4, the Children's LNNB accurately classified 87 percent of the normal subjects and 87 percent of the learning disabled subjects. Further, three of the 23 learning disabled subjects were misclassified while two of the 15 normal subjects were likewise misclassified. These results are very similar to other investigations that report overall hit-rates in the same range for this clinical population (Geary et al. 1982).

Insert Table 4 about here

Finally, a stepwise discriminant function analysis * was performed to examine the particular combination of scales that provided maximum group

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* The three achievement scales (writing, reading, arithmetic) were eliminated from the analysis due to limited N and the study's interest in neuropsychological functions vs. school achievement measures.

discrimination. Table 5 shows that the Expressive scale was the variable

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Insert Table 5 about here

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that contributed the most of all eight measures to the significant group separation. All other variables entered in the analysis after step 1 did not contribute or add to the separation between groups. It appears then, that the significant factor was the Expressive scale. This finding may be most clearly understood by examination of the intercorrelation matrix among variables revealing that the Expressive scale is highly correlated with most of the Children's LNNB, suggesting the largest fraction of common variance. Thus, one may tentatively infer that the two groups are significantly different on this scale (see T-test in Table 1) and may demonstrate the fact that learning disabled children have generalized expressive (verbal) problems. Some support for this statement may be validated in a study by Nolan et al. (1982) who found that the Expressive, Writing, and Reading scales of the Children's LNNB successfully discriminated the poor reading/spelling group from normal controls and a group of children deficient in arithmetic only.

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LURIA-NEBRASKA NEUROPSYCHOLOGICAL BATTERY
CHILDREN'S REVISION

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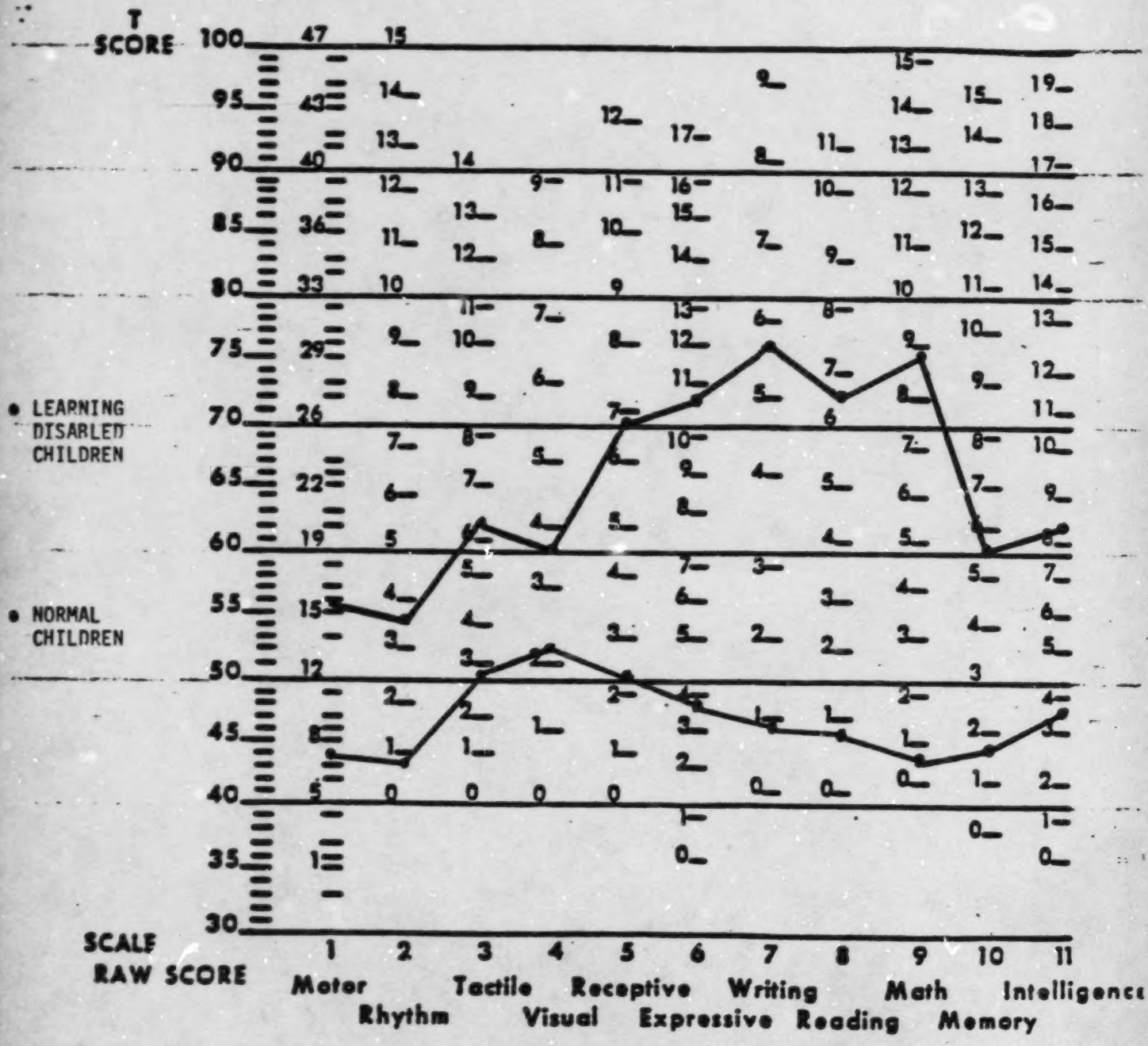

FIGURE I: Mean T-scores by group for each scale of the Luria-Nebraska Neuropsychological Battery - Children's Revision

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TABLE 1

Means, Standard Deviations, and T-Tests
for Differences Between Normal and Learning Disabled Groups
on the Luria-Nebraska Neuropsychological Battery - Children's Revision

	Normal (N=15)		Learning Disabled (N=23)		
Scale	$\bar{X}$	SD	$\bar{X}$	SD	T-Value
Motor	43.93	5.52	55.95	10.14	4.19*
Rhythm	43.46	6.20	54.60	11.08	3.53*
Tactile	50.59	8.33	62.39	13.51	3.01*
Visual	52.13	9.61	60.13	11.15	2.27
Receptive	50.59	10.57	70.43	15.43	4.34*
Expressive	48.06	7.03	71.82	16.44	5.27*
Writing	46.59	6.19	76.34	14.13	7.66*
Reading	46.13	5.75	72.21	13.13	7.22*
Arithmetic	44.13	2.53	75.47	18.21	6.59*
Memory	45.00	8.27	60.34	13.54	3.92*
Intelligence	48.00	8.75	62.08	12.32	3.83*

* For all T-Values, $p < .01$

TABLE 2

Correlation Coeficients Among the Scales of the
Luria-Nebraska Neuropsychological Battery - Children's Revision
for Learning Disabled Children

Variable	MOT	RHY	TACT	VIS	RECP	EXP	MEM	INTELL
MOT								
RHY	0.36							
TACT	0.21	0.57						
VIS	0.30	0.46	0.35					
RECP	0.33	0.54	0.40	0.42				
EXP	0.65	0.56	0.32	0.49	0.64			
MEM	0.41	0.43	0.34	-0.03	0.42	0.57		
INTELL	0.54	0.48	0.42	0.53	0.43	0.75	0.49	

TABLE 3

Correlation Coeficients Among the Scales of the
Luria-Nebraska Neuropsychological Battery - Children's Revision
for Normal Children

Variable	MOT	RHY	TACT	VIS	RECP	EXP	MEM	INTELL
MOT								
RHY	0.41							
TACT	0.28	0.38						
VIS	0.10	-0.04	0.21					
RECP	0.32	0.24	0.36	0.25				
EXP	0.37	0.28	0.34	0.24	0.68			
MEM	-0.05	-0.06	-0.05	-0.13	0.37	0.55		
INTELL	-0.10	-0.07	-0.05	0.35	-0.18	0.33	0.09	

TABLE 4

Number and Percent of Correctly Identified
Normal and Learning Disabled Subjects
Luria-Nebraska Neuropsychological Battery - Children's Revision

Classification	Group			
	Learning Disabled		Normal	
Correct	N	%	N	%
	20	87	13	87
Incorrect	3	13	2	13

TABLE 5

Summary of Discriminant Analysis
Luria-Nebraska Neuropsychological Battery - Children's Revision

Stepwise Analysis			
Steps Entered	Variable	Wilk's lambda	R^2
1	Expressive	0.56	.43
2	All Other Scales	0.56	.43